

PATENT ABSTRACTS OF JAPAN

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(54) INFORMATION RECORDING METHOD AND INFORMATION RECORDER

(57)Abstract:

PROBLEM TO BE SOLVED: To secure the reliability of reproduction interchangeability in a DVD player by suppressing the linking fluctuation caused by the updating operation of the control information to control user's data by the write once operation when the user's data are recorded to a write once medium. SOLUTION: Dummy data 33 of a plurality of continuous blocks are recorded in one operation before a final IFO 8 which is the control information is recorded and the final IFO 8 is recorded after the dummy data. By this procedure the

deterioration of linking accuracy can be suppressed by the linking part of the control information and the control information is normally read at the interchangeable reproduction made by the DVD player.

CLAIMS

[Claim(s)]

[Claim 1]

In an information storage method which records data to an information recording medium which cannot rewrite data on the basis of a synchronized signal obtained from said information recording medium

Dummy data is recorded on said information recording medium

An information storage method recording management information which manages said data on the basis of a synchronized signal which exists in said dummy data.

[Claim 2]

In an information storage method which records data on an information recording medium which cannot rewrite data per predetermined record

Data is recorded on said information recording medium

An information storage method recording management information which manages dummy data and said data beyond 2 record units at least on the basis of a synchronized signal obtained from said information recording medium by one recording operation.

[Claim 3]

An information storage method characterized by said predetermined record unit being an ECC block unit in an information storage method according to claim 2.

[Claim 4]

An information storage method recording said management information which consists of two or more files in an information storage method according to claim 1 on DVD-R which is said recording medium.

[Claim 5]

An information storage method recording individually each file which constitutes said management information in an information storage method according to claim 4.

[Claim 6]

In an information storage device which records data to an information recording medium which cannot rewrite data on the basis of a synchronized signal obtained from said information recording medium

A means to record dummy data on said information recording medium

An information storage device provided with a means to record management information which manages said data on the basis of a synchronized signal which exists in said dummy data.

[Claim 7]

In an information storage device which records data on an information recording medium which cannot rewrite data per predetermined record

A means to record data on said information recording medium

An information storage device provided with a means to record management information which manages dummy data and said data beyond 2 record units at least on the basis of a synchronized signal obtained from said information recording medium by one recording operation.

[Claim 8]

An information storage device characterized by said predetermined record unit being an ECC block unit in the information storage device according to claim 7.

[Claim 9]

An information storage device recording said management information which consists of two or more files in the information storage device according to claim 8 on DVD-R which is said recording medium.

[Claim 10]

An information storage device recording individually each file which constitutes said management information in the information storage device according to

claim 9.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

This invention relates to the record art of the data to a recordable optical disc.

[0002]

[Description of the Prior Art]

The optical disc could record mass information and is provided with the feature in which compatibility with a recording medium is possible.

[0003]

DVD (Digital Versatile Disc) which can treat mass information including a computeran imageand musicwith the same recording medium in various optical discs attracts attention as new mass storage mediasuch as PC and AV equipment.

In addition to the spread of the DVD players only for reproductiona commercial scene is quickly expanded by the appearance of the DVD recorder whose record is also possible.

[0004]

Importance is attached to the compatibility of the optical disc as a user's request with the spread of recording type optical disks. Howevermany DVD players which have already spread widelyDVD-RAM which is the rewritable format adopted with the DVD recorder (DVD-Random Access Memory)Since DVD-RW (DVD-ReWritable) etc. are not supportedit is incompatibleand there are some which cannot play the optical disc recorded with DVD-RAM of the rewritable formatetc. with a DVD player. Thereforethere is a trend which is going to secure high

compatibility by supporting the medium of DVD-R which is a recording type optical disk at the time of establishment of the DVD-R (DVD-Recordable) standard based on a DVD-video format.

[0005]

When recording data on real time it is before finishing recording data all over a disk and when arbitrary data is recorded a device may be turned off or a disk may be removed from a device. In order to guarantee the postscript of new data after the already recorded data at this time it is necessary to manage the data recorded on the disk by that point in time. For this reason the management information (it is henceforth called a middle IFO file) for managing this disk is updated whenever it records data.

[0006]

When the data of an image scene is recorded on drawing 1 by a file format the state where the middle IFO file is updated on DVD-R is shown. Generally the record section of a disk is divided into the field (the video information field 1 is called) which records an user datum and the management information field 2 which manages the file which is the data recorded on the disk according to the kind. Drawing 1 (a) shows the physical relationship on DVD-R of a middle IFO file when it records to the image scene 2 and the file of each image scene. The file 4 of the image scene 2 is added so that it may lead to the file 3 of the image scene 1 continuously. Since the file structure on a disk changed by having added the file 4 of the image scene 2 in order to newly update management information the middle IFO file 2 (numerals 5) is recorded.

[0007]

Since DVD-R is a write once medium it cannot carry out record then overwrite which was said for a new middle IFO file after an old middle IFO file. For this reason also when updating management information a postscript is added so that it may be continuously connected with the data recorded on last time like the video information field 1. Therefore the middle IFO file added at the end will show the file structure on the newest disk.

[0008]

Following drawing 1 (a) drawing 1 (b) adds the file of an image scene and it is the file 6 of image scene N and the opening of disk storage capacity becomes less insufficient and it shows the state where it became impossible to add an image scene. The file structure on DVD-R is completed at this time and the information which manages that state is shown by the middle IFO file N (numerals 7).

Therefore if the middle IFO file N (numerals 7) is renewable the file of all the image scenes can be accessed.

[0009]

However in a DVD player it cannot reproduce in the state of drawing 1 (b). This originates in the device characteristic of a DVD player of having assumed playback of the DVD-ROM disk manufactured by prepress. The format of DVD-ROM has prescribed that video information etc. record on spiral shape toward a periphery from inner circumference. Also when recording on a DVD-R disk in order to carry out compatible reproduction with a DVD player it is necessary to record like the disk in a DVD-ROM format without including a non-recording part etc. continuously from inner circumference.

[0010]

A user finishes record of data (file) and in order to make the disk whose compatible reproduction is possible with a DVD player it is necessary to perform FAINA rise processing. If FAINA rise processing is performed as shown in drawing 1 (c) the middle IFO file N (numerals 7) updated at the end will newly be added in the form based on the format of DVD-ROM as final management information (henceforth: call the last IFO file 8). A DVD player is playing this last IFO file 8 the file structure on a disk is acquired and access to each picture image data is attained. an unrecorded portion is filled up with the dummy data 9 and is changed into the state where it is continuously filled with a certain data from inner circumference. In such the state a DVD-R disk is renewable with a DVD player for the first time.

[0011]

When adding each IFO file and the file of the image scene the joint called linking among these files occurs. This linking is further explained using drawing 2. A disk with the eccentricity of 80 micrometers is mentioned as an example and this figure explains it.

[0012]

Drawing 2 (a) is a mimetic diagram showing the linking part formed on a disk by adding the file of an image scene. The trailer of the record data 10 to last time (the N-1st) and the leader to which the recording start of the ***** data 12 at the time of starting record of picture image data (the Nth) is carried out are recorded as the linking part 13 of drawing 2 (a) showed.

[0013]

In the compatibility with reproduction in a DVD player etc. in order to secure high reliability linking as ideally shown in drawing 2 (c) is required. However since the linear velocity of a track is changed under the influence of the eccentricity of a disk when actually recording postscript data the gap part 15 which is not recorded as shown in drawing 2 (b) occurs or the overlap portions 16 occur by the data as conversely shown in drawing 2 (d).

[0014]

Among the recorded data since it will be destroyed the data of the overlap portions 16 may drop the correcting capability by ECC (Error Correcting Code) on the recording medium of write once like DVD-R. If the section of these overlap portions 16 becomes long influence will arise also in servo control. Correcting capability by ECC is not dropped but if it is going to lessen overlap 16 portion as much as possible so that servo control may not be affected either it will become easy to generate the unrecorded gap part 15 conversely.

[0015]

in the case of a recording medium of write once like DVD-R in the overlap portions 16 of the recorded data the both sides of the data which was alike from the first and was recorded and the data overwritten when adding a postscript will be destroyed. As conventional technology in consideration of this problem make

into dummy data the ECC block containing a linking part and it is skipped or the technique of inserting dummy data only near the linking part and suppressing lack of information to the minimum is indicated. (For example refer to patent documents 1)

The data added with the original data when the gap 15 which is not recorded on between data and data arises Since the servo control of the DPD (Differential Phase Detection) method using a recording mark is adopted when it is a DVD player of a reproduction special-purpose machine although both sides are not destroyed In a non-recording part a servo cannot be applied and recorded information cannot be read normally.

[0016]

In order to reproduce a recorded type recording medium with a DVD player as other conventional technologies in consideration of this problem the method of recording overlapping the start edge portion of the data added to the data trailer of a front recording part so that an unrecorded gap may not occur is indicated. (For example refer to patent documents 2)

[0017]

[Patent documents 1]

JP9-270171A

[Patent documents 2]

JP11-25459A

[0018]

[Problem(s) to be Solved by the Invention]

However on the occasion of the postscript record of a file with little data volumes such as an IFO file there was a case where high linking accuracy could not be held only by above-mentioned conventional technology. Below the reason is described.

[0019]

In order to generate the timing of a recording start position at the time of the postscript of an IFO file or the file of an image scene it is necessary to

synchronize to what becomes a certain standard. This standard is based on the synchronized signal (SYNC). There are two kinds of SYNC(s) and there is a record method using each. A record method on the basis of the synchronized signal (example: LPP-SYNC) with which the 1st is beforehand recorded on the disk. The 2nd has a record method on the basis of the synchronized signal (example: SYNCcode) contained in the data recorded before.

[0020]

Generally the detection ratio of LPP-SYNC falls in the portion on which data is already recorded. Therefore it is made to synchronize with SYNC code in the already recorded data and the method of generating the timing of a recording start position is adopted.

[0021]

In the record method which synchronizes to SYNC code of this data division and generates the timing of a recording start position. When the postscript of little file of data volume for example the IFO file recorded on the management information field 2 was repeated and was performed it turned out that the amount of change of a linking part may be expanded. The generating mechanism is explained using drawing 3.

[0022]

Drawing 3 (a) is a figure by which it is generated when management information is added and in which showing an example of change of a linking part. Drawing 3 (b) shows change of the synchronization position of the timing generation at the time of adding each management information and a recording start position.

[0023]

In drawing 3 change of a recording start position is set to $\pm 10T$ at the maximum and the first data [Nth] 17 presupposes that SYNC code in the data already recorded as LPP-SYNC has a right location relation. The timing which determines a recording start position presupposes that it generates synchronizing with SYNC code of the data in front of two. Let all data volume of 5th [+] N-N be the same things for the facilities of explanation.

[0024]

The recording start timing synchronized and generated by SYNC code in front of two respectively here by the N+2nd data 18 and the N+4th data 20. Change of 10T is carried out in the direction which is in a recording start position and suppose that change of 10T was carried out in the direction in which a recording start position is shifted by the N+3rd data 19 and the N+5th data 21.

[0025]

Although the amount of change of the recording start position in the 1st time and the 2nd postscript is 10TAs shown in drawing 3 (a) the overlap 22 of 20T occurs in the linking part between the N+2nd data 18 and the N+3rd data 19. The gap 23 which is not recorded [of 30T] occurs in the linking part between the N+3rd data 19 and the N+4th data 20 and the overlap 24 of 40T occurs in the linking part between the N+4th data 20 and the N+5th data 21. This figure shows that change of the linking part is expanded as it repeats the postscript.

[0026]

The factor which such a big change generates is because the data which generates recording start timing is generating synchronizing with SYNC code of the data recorded before two or more (2 or more) times. Generally it is necessary to begin to attain synchronization for generating the timing of a recording start position from a recording start position from before 2 - tens ECC blocks (an ECC block is a record unit of the data recorded on a disk.). This is for preventing SYNC un-detecting according to the defect etc. of the recorded data and erroneous detection and securing the reliability of SYNC detection.

[0027]

Therefore data volume of about 1-2 ECC blocks such as management information in the postscript of little data. It becomes easy to receive the influence of change of the recording start position of the data already recorded and is easier to generate a big change of the recording start position of postscript data like the file of an image scene than the postscript of data with much data volume.

[0028]

When especially this invention person recorded last IFO8 shown in drawing 1 the problem shown above arose and he could not read management information normally depending on the kind of DVD player but found out that disk recognition might become impossible.

[0029]

The purpose of this invention suppresses the overlap of data and change of the recording position of data called the gap between data and there is in providing the information storage art which can raise the reliability of data reproduction.

[0030]

[Means for Solving the Problem]

In order to attain the above-mentioned purpose in this invention to an information recording medium which cannot rewrite data. In recording management information which manages said data to information storage art which records data on the basis of a synchronized signal which exists in data already recorded on said information recording medium Dummy data is recorded and recording start timing of said management information is determined on the basis of a synchronized signal which exists in said dummy data and suppose that said management information is recorded according to said recording start timing.

[0031]

In this invention information storage art which records data on an information recording medium which cannot rewrite data per predetermined record on the basis of a synchronized signal which exists in data already recorded on said information recording medium is received In recording management information which manages said data suppose that combination data which combined dummy data beyond 2 record units before said management information record at least is considered as composition recorded by one recording operation.

[0032]

[Embodiment of the Invention]

Below is an information storage device of the 1st example that applied this invention the DVD camera which records an image scene (video) and a still

picture on a DVD-R disk is mentioned as an example and is explained. It is the most desirable although this invention is applied photoing [that is] the image scene and still picture of several 10 second bits repeatedly in many cases since there is much number of times of a postscript as a use of a DVD camera compared with other information storage devices. However even if it is other information storage devices for example a DVD recorder it cannot be overemphasized that it is a scope of this invention.

[0033]

The block diagram which the portion related to the data recording to DVD-R constitutes among the DVD cameras which are the examples of this invention is shown in drawing 4. This example comprises the higher order controller 25 the modulation part 26 the record data generating part 27 the timing generating part 28 the Records Department 29 the regenerating section 30 the data discrimination part 31 and the demodulation section 32. These each block is controlled by control circuitssuch as CPU which is not illustrated.

[0034]

The higher order controllers 25 are the sources of information of recorded information. That is the data of the image scene photoed by the camera part which is not illustrated is transmitted to the modulation part 26 from the higher order controller 25. The data to which it restored by the demodulation section 32 is transmitted to the higher order controller 25.

[0035]

Hereafter the operation at the time of record is explained. The higher order controller 25 sends recorded information to the modulation part 26. The modulation part 26 performs 8/16 conversion which changes the addition and recorded information on the code (ECC) for error corrections into the form of a recording mark. The record data generating part 27 generates the pulse form-type record data binary-ized in the NRZI form of Hi level and Lo level based on the data changed 8/16. The NRZI signal which is record data is sent to the Records Department 29 synchronizing with the record timing generated by the

timing generating part 28. The timing generating part 28 generates record timing on the basis of the synchronized signal from the data discrimination part 31. The record data synchronized by the synchronized signal by the timing generating part 28 is sent to the Records Department 29 one by one. It consists of an optical head which consists of a semiconductor laser driving circuit and a semiconductor laser optical system and a moving mechanism. Record data is sent to a semiconductor laser driving circuit and the Records Department 29 drives a semiconductor laser and makes a laser beam emit light. The laser beam emitted from the optical head is irradiated by the record film side of an optical disc and a recording mark is formed.

[0036]

When reading the data recorded on the optical disc, the regenerating section 30 performs. The regenerating section 30 is the same optical head as the Records Department 29 and detects the catoptric light which condensed on the optical disc [time / of record] whose weak laser beam has been recorded and was modulated by the recording mark. The regenerating section 30 outputs a servo signal required for the regenerative data tracking and focus control which are the information recorded on the optical disc etc. Regenerative data discriminates from the synchronized signal (SYNC pattern) and user data such as video information which show the recovery starting point of data by the data discrimination part 31. It gets over by the demodulation section 32 and an user datum is sent to the higher order controller 25. It may be made to detect the synchronized signal (example: LPP-SYNC) currently beforehand recorded on the disk which mentioned the data discrimination part 31 above and may be made to detect the synchronized signal (example: SYNC code) contained in the data recorded before. However it is more desirable to have detected the synchronized signal contained in the data recorded before since it was hard coming to play it after the synchronized signal currently beforehand recorded on the disk records data.

[0037]

The modulation part 26the record data generating part 27the timing generating part 28the data discrimination part 31and the demodulation section 32 may be constituted so that it may process in hardware using a circuitand they may be made the composition which processes by software using a program.

[0038]

As for middle IFOthe disk which recorded the user datum of image scene 50 batch with the camera of the higher order controller 25 is updated 50 times. Change of the recording start position per linking is less than [$\frac{1}{10}T$]. In a video information fieldas shown in drawing 5 (a)even if it repeats a postscriptthe fluctuation range of a linking part is not expanded. The ECC block on which data volume of video information is large and this reason is recorded at once (an ECC block) It is a record unit of the data recorded on a disk in this example. It is because it is generated from the picture-image-data part recorded just before the recording start timing of postscript data did not contain a linking partsince it was large.

[0039]

Howeverthe block count which records at once the IFO file which is management information is 2 ECC blocks. And since [on which the recording start timing is already recorded] more than one are generated from a pre- IFO filerecording start timing is decided in the form which accumulates the linking error of the portion.

[0040]

Thereforeas shown in drawing 5 (b)whenever it repeats a postscriptthe fluctuation range of the above-mentioned linking part is expanded. In the postscript of data performed conventionallythe postscript was performed for usessuch as program recording and voice recordingin many casesand since the number of times of a postscript at this time was about at most several timesit was not able to carry out the knowledge of such a problem. It begins by this invention person and knowledge can be carried out.

[0041]

The last IFO recorded at the time of the FAINA rise after 50 scenes was understood that change of a linking part may become by 40T order in the experiment by this invention person. It also turned out experimentally that reproduction is normally impossible depending on the kind of DVD player from the hit where the width of the gap of a linking part exceeds 30T.

[0042]

Therefore in order to raise the reliability of the data reproduction in a DVD player it turned out that it is required to make less than 30T change of the linking part of the last IFO which a DVD player reproduces.

[0043]

In the information storage device of this example data is recorded on DVD-R in the form which does not insert dummy data after the last IFO as shown in drawing 6 (a) but inserts the dummy data 33 between middle IFO7 and last IFO8 as shown in drawing 6 (b). The dummy data 33 is made larger than 2 record units for example 2 ECC blocks at the block count required for an optical disk unit to generate recording start timing and a twist concrete target. The concept of operation when recording last IFO8 by carrying out physical relationship of each file of middle IFO the last IFO and dummy data like drawing 6 comes to be shown in drawing 7.

[0044]

Between the middle IFO file of 50 scene eye and the dummy data 33 the overlap part or gap part of $\pm 40T$ occurs at the maximum. On the other hand by inserting the dummy data 33 the recording start timing at the time of recording last IFO8 (it comprises the VIDEO_TS.IFO file 37 the VIDEO_TS.VOB file 38 the VIDEO_TS.BUP file 39 and the VTS_01_0.IFO file 40) SYNC code in the dummy data 33 is detected and it synchronizes. For this reason since timing generation is carried out from the data (dummy data 33) recorded just before a linking part was not included record timing is generable on the same conditions as the postscript of the file of an image scene with large data volume. Therefore the accuracy of a linking part is equivalent to what is shown by drawing 5 (a) the change 34 of the

linking part of the last IFO can be suppressed to less than [**10T]and the reliability of data reproduction can be raised.

[0045]

Although it aims at the improvement in reliability of the compatible reproduction of reproducing the data recorded with the DVD camera with a DVD playeralso in record of middle IFOthe same art can be used for the example described here in order to raise the reliability of self-reproduction.

[0046]

When the last IFO was being recorded after middle IFOwithout inserting the conventional dummy datathere was a case where about [40T] dispersion occurred in the linking portion of the last IFOand could not be reproduced as a result depending on a DVD player with the probability of one sheet among ten disks. In the result of having applied this example to itin the linking part of the last IFO sectionsince it was stopped by dispersion within 10Treproduction became possible satisfactorily.

[0047]

The 2nd example that applied this invention to below is described. It is only that the record procedure of data changesand since the composition of the information storage device itself and operation are the same as the 1st exampleexplanation is omitted. . In the 2nd examplerecord at the time of a FAINA rise. The VIDEO_TS.IFO file 37 which constitutes the dummy data file 33 and the last IFO file 8the VIDEO_TS.VOB file 38the VIDEO_TS.BUP file 39and the VTS_01_0.IFO file 40 are recorded individuallyrespectively. The operation in this case is shown in drawing 8. When recording the data of each management information file and making it the reference position of record timing generate synchronizing with SYNCcode in the same dummy data file 33The conventional record control can be used as it isand change of a linking part is **20T at the maximumand can be satisfactorily reproduced with a DVD player. Since this record method is realizable by the existing record controlcompared with the 1st examplean above-mentioned effect is acquired easily.

[0048]

The 3rd example that applied this invention to below is described. As well as the case of the 2nd example since the composition of the information storage device itself and operation are the same as the 1st example explanation is omitted. In the 3rd example as dummy data is not inserted after the last IFO as shown in drawing 9 (a) but shown in drawing 9 (b) dummy data and the last IFO are used as the one data 35 and dummy data and the last IFO are recorded at once. The operation in this case is shown in drawing 10.

[0049]

Between the middle IFO file of 50 scene eye and the dummy data 33 the overlap part or gap part of **40T occurs at the maximum like the case of the 1st and 2nd example. On the other hand dummy data and the last IFO are recorded on DVD-R as one data. The recording start timing at the time of recording last IFO 8 (it comprises the VIDEO_TS.IFO file 37 the VIDEO_TS.VOB file 38 the VIDEO_TS.BUP file 39 and the VTS_01_0.IFO file 40) Although SYNC code in middle IFO already recorded is detected and synchronized since the linking part itself does not occur between dummy data and the last IFO the 1st example and the effect more than equivalent are acquired.

[0050]

Although record of a last IFO file was mentioned as the example and this example explained it if data shorter than the length of the data required in order to measure record timing irrespective of the kind of data is repeated and added it cannot be overemphasized that this invention is applicable.

[0051]

Although DVD-R was mentioned as the example and explained if it is record of the information over the recording medium which is not rewritable it is in the scope of this invention.

[0052]

The composition of an information storage device should just also be the composition which is not restricted to the composition shown in drawing 4 detects

a synchronized signal from the recording medium which is going to record data measures record timing with this synchronized signal and can record data.

[0053]

[Effect of the Invention]

According to this invention the overlap of data and change of the recording position of data called the gap between data can be suppressed and the reliability of data reproduction can be raised.

[Brief Description of the Drawings]

[Drawing 1] When drawing 1 records the data of an image scene by a file format it is a figure showing the state where the middle IFO file is updated on DVD-R.

[Drawing 2] Drawing 2 is a figure showing the linking part produced between files.

[Drawing 3] Drawing 3 is a figure showing change of the length of a linking part.

[Drawing 4] Drawing 4 shows the block diagram which the portion related to the data recording to DVD-R constitutes among the DVD cameras which are the examples of this invention.

[Drawing 5] Drawing 5 is a figure showing the range of fluctuation of the linking part to the linking number in each record section.

[Drawing 6] Drawing 6 is a figure showing the physical relationship of the file of the 1st example in this invention.

[Drawing 7] Drawing 7 is a figure showing the concept of the recording operation at the time of performing the 1st example.

[Drawing 8] Drawing 8 is a figure showing the physical relationship of the file of the 2nd example in this invention.

[Drawing 9] Drawing 9 is a figure showing the concept of the recording operation at the time of performing the 2nd example.

[Drawing 10] Drawing 10 is a figure showing the concept of the recording operation at the time of performing the 3rd example.

[Description of Notations]

25 [-- A timing generating part 29 / -- The Records Department 30 / -- A regenerating section 31 / -- A data discrimination part 32 / -- Demodulation

section.] -- A higher order controller²⁶ -- A modulation part²⁷ -- A record data generating part²⁸

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]When drawing 1 records the data of an image scene by a file format it is a figure showing the state where the middle IFO file is updated on DVD-R.

[Drawing 2]Drawing 2 is a figure showing the linking part produced between files.

[Drawing 3]Drawing 3 is a figure showing change of the length of a linking part.

[Drawing 4]Drawing 4 shows the block diagram which the portion related to the data recording to DVD-R constitutes among the DVD cameras which are the examples of this invention.

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[Drawing 7]Drawing 7 is a figure showing the concept of the recording operation at the time of performing the 1st example.

[Drawing 8]Drawing 8 is a figure showing the physical relationship of the file of the 2nd example in this invention.

[Drawing 9]Drawing 9 is a figure showing the concept of the recording operation at the time of performing the 2nd example.

[Drawing 10]Drawing 10 is a figure showing the concept of the recording operation at the time of performing the 3rd example.

[Description of Notations]

25 [-- A timing generating part²⁹ / -- The Records Department³⁰ / -- A regenerating section³¹ / -- A data discrimination part³² / -- Demodulation

section.] -- A higher order controller26 -- A modulation part27 -- A record data
generating part28
